

CLAIMS

1. A gallium-nitride-based light-emitting apparatus comprising:

5 a substrate;
 a first-conducting-type clad layer formed on the substrate;
 an active layer formed on the clad layer; and
 a second-conducting-type clad layer formed on the active
layer,

10 the active layer including barrier layers and well layers made of a gallium-nitride-based compound semiconductor, wherein the barrier layers of the active layer include a first barrier layer formed toward the first-conducting-type clad layer and second barrier layers sandwiched by the well layers,

15 the light-emitting apparatus comprises a second-conducting-type carrier block layer between the active layer and the second-conducting-type clad layer, and the band gap E_{gb} of the carrier block layer, the band gap E_{g2} of the second barrier layer, the band gap E_{g1} of the first barrier layer and the band gap E_{gc} of the clad layers satisfy the relationship $E_{gb} > E_{g2} > E_{g1} \geq E_{gc}$.

20 2. A gallium-nitride-based light-emitting apparatus according to claim 1, wherein the thickness d_1 of the first barrier layer and the thickness d_2 of each of the second barrier layers satisfy the relationship $d_1 > d_2$.

25 3. A gallium-nitride-based light-emitting apparatus according to claim 2, wherein the thickness d_1 of the first barrier layer

satisfies the relationship $d_1 \leq 50$ nm.

4. A gallium-nitride-based light-emitting apparatus according to claim 1 or 2, wherein the thickness d_3 of each of the well layers 5 satisfies that the relationship $d_3 \leq 4$ nm.

5. A gallium-nitride-based light-emitting apparatus according to any one of claims 1 to 4, wherein the first barrier layer and the second barrier layers comprise $\text{Al}_x\text{In}_y\text{Ga}_{1-x-y}\text{N}$ ($0 \leq x \leq 0.3$ and 10 $0 \leq y \leq 0.05$), and wherein the well layers comprise $\text{Al}_a\text{In}_b\text{Ga}_{1-a-b}\text{N}$ ($0 \leq a \leq 0.01$ and $0 \leq b \leq 0.1$).

6. A gallium-nitride-based light-emitting apparatus according to any one of claims 1 to 5, wherein the carrier block layer comprises 15 $\text{Al}_p\text{In}_q\text{Ga}_{1-p-q}\text{N}$ ($0 \leq p \leq 0.5$ and $0 \leq q \leq 0.1$).

7. A gallium-nitride-based light-emitting apparatus according to any one of claims 1 to 6, wherein the clad layers comprise a super-lattice structure formed by stacking layers of $\text{Al}_\alpha\text{In}_\gamma\text{Ga}_{1-\alpha-\gamma}\text{N}$ (20 $0 \leq \alpha \leq 0.2$ and $0 \leq \gamma \leq 0.1$) and layers of $\text{Al}_\beta\text{In}_\eta\text{Ga}_{1-\beta-\eta}\text{N}$ ($0 \leq \beta \leq 0.05$ and $0 \leq \eta \leq 0.1$).